



Fish & Wildlife
Division

SPECIES AT RISK

Inventory of
Tiny Cryptanthe (*Cryptantha minima*)
and
Small-flowered Sand Verbena (*Tripterocalyx micranthus*) in
Alberta



Alberta Species at Risk Report No. 119

November 2008

Alberta

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Sand Verbena (*Tripterocalyx micranthus*) in Alberta

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EXECUTIVE SUMMARY

Alberta Sustainable Resource Development, Fish and Wildlife Division, initiated an inventory of small-flowered sand verbena (*Tripterocalyx micranthus*) and tiny cryptanthe (*Cryptantha minima*) in southern Alberta in July 2007, in order to obtain additional information on their populations, abundance and distribution. Priority areas for this survey included the Bow River populations (Hays Southeast, Hays Southwest, Grassy Lakes, and Purple Springs), north of Medicine Hat, and near McNeill. Prioritization of these areas occurred because of the absence of other survey efforts covering these known populations of tiny cryptanthe and/or sand verbena.

Surveys were conducted of known locations of tiny cryptanthe and small-flowered sand verbena on public land between July 17 and 28, 2007. A total of 3391 tiny cryptanthe plants was estimated during 2007, primarily in Hays Southeast. The Hays Southeast population increased from 576 to 3345 plants between 2004 and 2007; not all 2004 sub-populations were visited, and several new sites were documented. No populations were found at the Grassy Lake and McNeill locations or in 7 out of 9 sites near Medicine Hat. The Medicine Hat population declined from 6600 to 46 plants; but again, not all sub-populations were visited. The sites in Hays southeast where tiny cryptanthe were not found generally had dense cover of little club moss and grass, and less than five percent bare ground. There appears to be a negative correlation with little club moss that may provide some insights into the habitat requirements of tiny cryptanthe.

Tiny cryptanthe populations were affected by grazing, vehicle traffic, reclamation, and invasion of non-native species. Grazing, occasional vehicle use and wind action appears to promote the loose bare soil that is optimal for tiny cryptanthe, while heavy vehicle use or road maintenance compacts the soil. Reclamation seed mixes with crested wheatgrass, rhizomatous wheatgrasses and downy brome may out-compete tiny cryptanthe. Mowing competitive species may allow tiny cryptanthe to compete. Russian thistle did not appear to compete. Further surveys should be done with permanently marked quadrats in a variety of locations, in a variety of years to determine trends and variability.

A total of 1400 small-flowered sand verbena plants was counted during 2007, substantially fewer than the 4082 found in 2002. The largest populations were in the two most disturbed sub-populations: a large dune at Purple Springs that is used by ATVs, and a sand extraction pit at Grassy Lake. Population numbers in 2007 were higher than 2004 in 4 out of 7 populations. The largest decline between 2007 and 2004 was in the Grassy Lake site where a sand pit has removed most of the habitat.

Small-flowered sand verbena is adapted to the edges of active dunes where there is 70 percent bare ground and some shifting sand. Dune stabilization, reclamation, non-native invasive species, ATV and truck use, grazing, and sand extraction, may affect the populations. There may be other suitable dune habitats in Hays Southeast and Purple Springs that should be surveyed, as well as the known sites at Hays Southwest (Wolf Island).

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The views and opinions expressed are those of the author and do not necessarily represent the policies or positions of the Department or the Alberta Government.

TABLE OF CONTENTS

LIST OF FIGURES	5
INTRODUCTION.....	6
STUDY AREA.....	6
METHODS.....	7
TINY CRYPTANTHE.....	9
BACKGROUND.....	9
RESULTS.....	11
DISCUSSION.....	12
SMALL-FLOWERED SAND VERBENA.....	19
BACKGROUND.....	19
RESULTS.....	20
DISCUSSION.....	21
OTHER RARE SPECIES.....	26
REFERENCES.....	27

LIST OF FIGURES

Figure 1: Priority Areas for Rare Plant Inventories	8
Figure 2: Survey Locations for Tiny Cryptanthe	14
Figure 3: Survey Locations for Small-flowered Sand Verbena	23

LIST OF TABLES

Table 1: Legal Designations.....	6
Table 2: Comparison of similar annual cryptanthe species	9
Table 3: Habitat Suitability Criteria for Tiny Cryptanthe.....	10
Table 4: Survey Locations, Effort, and Populations of Tiny Cryptanthe, 2007.....	15
Table 5: Survey Locations, Effort, and Populations of Small-flowered Sand Verbena, 2007 ...	24

INTRODUCTION

Alberta Sustainable Resource Development (ASRD), Fish and Wildlife Division, initiated an inventory of small-flowered sand verbena (*Tripterocalyx micranthus*) and tiny cryptanthus (*Cryptantha minima*) in southern Alberta in July 2007, in order to obtain additional information on the populations, abundances and distributions of these species. Both species are listed under the federal *Species at Risk Act* (SARA) and under Alberta's *Wildlife Act* (Table 1).

The objectives of the survey were to conduct a population inventory of tiny cryptanthus and small-flowered sand verbena at identified priority locations in the province of Alberta; to map the perimeter of the populations with a Global Positioning System (GPS); and to recommend appropriate management at these sites. Additional objectives included recording incidental sightings of other rare plants or animals. This report provides baseline data on the locations and populations sizes of known occurrences in the general locations of Hays Southeast (Lower Bow River), Grassy Lake, Purple Springs, and some of the occurrences north of Medicine Hat.

The tiny cryptanthus information presented in this report helps to address urgent management activities outlined in the national recovery strategy. These activities include steps such as compiling all data on tiny cryptanthus, mapping locations and distribution of populations, and surveying and monitoring known locations of tiny cryptanthus. Similarly, new data for small-flowered sand-verbena will help to inform ongoing national recovery efforts.

Table 1: Legal Designations

Scientific Name	Common Name	Species at Risk Act	Wildlife Act
<i>Cryptantha minima</i>	Tiny cryptanthus	Endangered	Endangered
<i>Tripterocalyx micranthus</i>	Small-flowered sand-verbena	Endangered	Threatened

STUDY AREA

Tiny cryptanthus and small-flowered sand verbena occur in the Dry Mixedgrass Natural Subregion (Alberta Sustainable Resource Development 2003; Alberta Sustainable Resource Development 2004). Tiny cryptanthus occurs on level to sloping sites dominated by mixed-height grasses such as blue grama grass (*Bouteloua gracilis*), needle-and-thread grass (*Stipa comata*), and June grass (*Koeleria micrantha*). Small-flowered sand verbena occurs in active sand dunes.

Priority areas for this survey included the Bow River populations (Hays Southeast, Hays Southwest, Grassy Lakes, and Purple Springs), and selected areas along the South Saskatchewan River, outside of the Suffield Military Reserve and the Drowning Ford Grazing Reserve (north of Medicine Hat, and at McNeill) (Joel Nicholson pers. comm. June 2007) (Figure 1).

METHODS

Locations for tiny cryptanthus and small-flowered sand verbena were obtained from SRD (Joel Nicholson pers. comm. June 2007) and from the Alberta Natural Heritage Information Centre (2007). Universal Transverse Mercator (UTM) coordinates for each location were programmed into a Garmin 60csx Global Positioning System (GPS) unit, and county maps (Cypress County, MD of Taber, Hays Area Road Naming Convention) and NTS maps (Grassy Lake 72 E/1) were used to navigate. Landowners or leaseholders were contacted to obtain permission to access the land.

Surveys were conducted between July 17 and 28, 2007 when tiny cryptanthus and small-flowered sand verbena had set seed and were easy to identify. Locations within the target survey areas where tiny cryptanthus or sand verbena was documented in the past were located using the GPS. The GPS point was used as a centre point, and a minimum area of 10 m x 10 m was surveyed, with larger areas surveyed if the population extended further. Parallel transects were walked and all plants were marked with pin flags to ensure that plants were not double counted. Transects for tiny cryptanthus were approximately 2 m apart, while those for sand verbena were approximately 3 m apart. Tiny cryptanthus and sand verbena sub-populations were counted, or estimated (by counting a plants in a small area and multiplying by total area) if the occurrences were sufficiently large (greater than 500 plants). A mechanical counter was used for large populations to ensure accuracy. In most cases, the search area exceeded the population area, and the corners were marked with pin flags.

The search perimeter and population perimeters were recorded using the track function on the GPS. The pin flags were recovered and counted to ensure that none were left. The ground was scanned for tiny cryptanthus as we walked between sites, and new sites were documented.

The search effort for tiny cryptanthus was approximately 53 hours, not including travel time. The search effort for small-flowered sand verbena was approximately 34 hours, not including travel time. The effort was somewhat lower for sand verbena because the species typically grows in bare ground, in distinctive habitat (dunes), and the plants are reasonably large. However, in many cases small plants had already dropped their seeds and dried up and therefore were difficult to spot and identify. Tiny cryptanthus, on the other hand, has less well-defined habitat preferences, grow in more vegetated areas, had larger populations, and was difficult to see when small, especially after it had dried.

In this report, 'element occurrence (EO)' is used to refer to an element occurrence described and tracked by ANHIC. 'Sub-population' is used to refer to patches of plants that may be nested within an EO. 'Site' refers to a survey location, which may or may not have a sub-population of rare plants. Sub-populations are considered to be within the same EO if they are within 1 km of each other, or within 2 km if there is appropriate habitat between the sites (NatureServe website 2007).



Figure 1: Priority Areas for Rare Plant Inventories

Numbers correspond to Element Occurrences (EO_ID) (Alberta Natural Heritage Information Centre 2007)

TINY CRYPTANTHE

BACKGROUND

Description - Tiny cryptanthe (*Cryptantha minima* Rydb.) is a small annual plant in the Borage family (Boraginaceae). The bristly leaves and stems support numerous tiny white flowers along the slightly curved spike, with bracts interspersed between the flowers. Each bristly calyx encloses four hard seeds that are heteromorphic: one seed is large and smooth, and three seeds are smaller with small bumps (tuberculate) on the surface. The plants range in size from 2 cm to 20 cm tall depending on the conditions (Environment Canada 2006). Tiny cryptanthe flowers from late May to early July (COSEWIC 2002; Kershaw, Gould, Johnson and Lancaster 2001; Alberta Sustainable Resource Development 2004). A detailed description of tiny cryptanthe is available in the national recovery strategy (Environment Canada 2006).

Tiny cryptanthe could be confused with Fendler's cryptanthe (*Cryptantha fendleri*), a common annual species, or Kelsey's cryptanthe (*Cryptantha kelseyana*), a rare annual species, which has only recently been documented in Alberta and is ranked S1 G3 (Gould 2006), and May be at Risk (Alberta Sustainable Resource Development website 2005). The following table summarizes the characteristics of each species needed for identification (Table 2).

Table 2: Comparison of similar annual cryptanthe species

Species	Stem	Spike	Calyx	Nutlets
Fendler's cryptanthe, Fendler's cat's-eye <i>Cryptantha fendleri</i>	Simple or much branched.	Naked or nearly so; inflorescence with only a few bracts at base.	Midrib of calyx lobes only moderately thickened.	Smooth surfaced and same size.
Kelsey's cryptanthe, Kelsey's cat's-eye <i>Cryptantha kelseyana</i>	More or less bushy-branched; commonly without a strong central axis.	Naked; inflorescence without bracts or with only a few at the base.	Midrib of calyx lobes only moderately thickened.	Distinctly heteromorphic, one nearly smooth and somewhat larger and more firmly attached than the other three; three nutlets tuberculate; groove narrow, opening only at the base into a small areola.
Tiny or small cryptanthe, small cat's-eye <i>Cryptantha minima</i>	Usually numerous and branching (although small plants may be single stemmed).	Bracted; inflorescence with bracts subtending most of the flowers.	Asymmetrical, the linear-lanceolate lobes with midribs becoming thickened and bony, greener than <i>C. fendleri</i> .	Distinctly heteromorphic, one nearly smooth and somewhat larger and more firmly attached than the other three; three nutlets definitely tuberculate; groove triangular-dilated at base.

Sources: key characteristics compiled by Cheryl Bradley (pers. comm., June 3, 2007) from: Harrington 1954; Barkley 1986; Rydberg 1917; Cronquist, Holmgren, Holmgren, Reveal, and Holmgren 1984; Hitchcock, Cronquist, Ownbey and Thompson 1977; and Martin and Hutchins 1980.

Habitat - Tiny cryptanthe occurs in the dry mixed grass prairie in xeric sites with at least 10 percent exposed soils (sandy loam, loamy sand, silty sand and sand) that have been deposited rather than eroded (Alberta Sustainable Resource Development 2004). It occurs near river systems in three types of habitat: "1) sandy, level to rolling upland areas, and sand dunes near valley breaks; 2) valley slopes with up to 50 percent slope; and 3) level or gently sloping terraces in the valley bottom, particularly in meander lobes" (Environment Canada 2006). Both Kelsey's cryptanthe and Fendler's cryptanthe have been found with tiny cryptanthe (Cheryl Bradley pers. comm. 2007).

The following habitat suitability criteria (Table 3) were developed by Bradley and Ernst (2006) from a review of all records of tiny cryptanthe in the province, overlaying biophysical GIS data available for Canadian Forces Base Suffield, and by referring to soils maps and descriptions from Landwise Inc. (2003) and Kjeirsgaard and Pettapiece (1986).

Table 3: Habitat Suitability Criteria for Tiny Cryptanthe

Parameter	Description
Vegetation	Dry mixed grass prairie dominated by needle-and-thread and blue grama grasses.
Bare soil	Low soil litter levels and a minimum of 10% bare soil, usually more.
Distance from river	Within 5 km.
Landform	Glaciofluvial terrace, river valley slope, coulee/ravine slope and bottom, shallow basin, sandy plain and sand dunes.
AGRASID Landscape Model	ATP, BUT, BVCV, CVD, CVPL, EXP and ZUN. These map units are characterized by fluvial or eolian parent material of medium to coarse texture. Soils are orthic brown chernozems, rego chernozems and orthic regosols (Landwise Inc. 2003).
Soil texture	Sandy loam, loamy sand, silty sand and sand.
Aspect	Usually south or east, infrequently north and west.
Slope	0-50% (0-25°(35°))
Moisture regime	Xeric, well-drained.

Source: Bradley and Ernst (2006)

Reproduction – Reproduction is by seed. Plant numbers fluctuate widely from year to year, depending on the amount and timing of rainfall, past seed production, germination rate, and competition with other species (Alberta Sustainable Resource Development 2004).

Locations - In Alberta, tiny cryptanthe is associated with river systems, mainly the South Saskatchewan River valley from Medicine Hat to the Saskatchewan border, the lower Bow, upper Oldman and Lost Rivers. In Saskatchewan, tiny cryptanthe has been found along the South Saskatchewan (near the Alberta border), and the Red Deer River. The nearest U.S. population is in northeast Montana, about 450 km southeast of the Alberta range (Alberta Sustainable Resource Development 2004). Tiny cryptanthe has spotty distribution in the U.S. Great Plains and most sub-populations consist of only a few plants (Saskatchewan Environment website 2007).

There are 28 populations (equivalent to element occurrence) in Alberta and 4 populations documented in Saskatchewan (Environment Canada 2006). Since the national recovery strategy was published, a substantial population was found in the Lost River valley (Bradley, Wallis and Wershler 2006).

Status - Tiny cryptanthus is listed as an endangered species in Alberta under the *Wildlife Act* (Alberta Sustainable Resource Development website, 2008), is ranked endangered in Saskatchewan (Saskatchewan Environment website 2007), and is listed as endangered on Schedule 1 of the federal *Species at Risk Act* (Government of Canada website 2008). Globally, tiny cryptanthus is ranked as demonstrably secure under present conditions (G5) (NatureServe website 2007).

Threats - Threats to tiny cryptanthus include cultivation or seeding to non-native pasture, development of oil and gas wells and pipelines, construction of permanent access roads and associated maintenance, herbicides, lack of grazing (in some areas), invasion of native grasslands by non-native plant species (in particular crested wheatgrass (*Agropyron pectiniforme*) and downy brome (*Bromus tectorum*), and urban and rural residential development (Environment Canada 2006, Alberta Sustainable Resource Development 2004). Only one-third of quarter sections in the Dry Mixedgrass Natural Subregion had more than 75 percent native vegetation based on air photos examined in 1991-1993 (Prairie Conservation Forum website, 2008), and development has continued since then. Extensive oil and gas development has occurred in the Lower Bow sites. Recent releases of European root weevil (*Mogulones cruciger*) as a biocontrol agent for hounds-tongue (*Cynoglossum officinale*) have a small potential to affect tiny cryptanthus populations (De Clerck-Floate and Schwarzländer 2002; Van Hezewijk, De Clerck-Floate, Moyer, Stewart and Brooke 2004).

RESULTS

ANHIC Rare Plant Report Forms were prepared for every survey site and have been electronically submitted to ANHIC. UTM coordinates of each location, and habitat descriptions are available from ANHIC. The survey sites are presented in Figure 2, and survey sites and the corresponding EO_id number (ANHIC's element occurrence number) are presented in Table 4.

A total of 3391 plants was estimated during 2007, primarily in Hays Southeast. The Grassy Lake population was not found, nor was the population at McNeill. The plants in Medicine Hat were small and nearly senescent or not present. Surveys in 2004 found greater than 7695 plants in these locations, while those in 2003 found none. Surveys in 2002 found 62 plants in Hays Southeast; no surveys were done in other locations that year. One leaseholder, in Hays Southwest, could not be contacted and therefore the property was not surveyed. One landowner, north of Medicine Hat, denied access and the property was not surveyed.

Hays Southeast (EO 7662) – The Hays Stock Grazing Association is a large area of rangeland on the northwest side of the Bow River, and just north of The Grand Forks where the Bow River and Oldman River join to become the South Saskatchewan River. The area has an extensive network of roads, wellsites and batteries.

We surveyed 27 sites in this area, 12 of which had been previously documented, 11 of which were new sub-populations, and one site 2.8 km away which may qualify as a new population (BTC021). Tiny cryptanthus was not found in three of the 12 known sub-populations. More than 3345 plants was estimated in Hays Southeast in 2007. Surveys in 2002 documented 62 robust plants in one sub-population, none were documented in 2003, and 576 plants were documented in 2004.

Some of the largest plants and sub-populations were along the shoulders of dirt tracks or little used roads (BTC002, 06, 09, and especially 08 and 21) where the wind had blown soil to the edges of the roads. The open ground on the edges of tracks at BTC008 (Figure 3) and 21 had exceptionally large specimens of

both tiny cryptanthus and Russian thistle (*Salsola kali*). However, four of the nine tracks surveyed had no tiny cryptanthus, and other roads were scanned as we drove and only one new population (BTC021) was found.

Most of the sub-populations on the crest, slopes and flats along the river valley were small in numbers and size, with the exception of BTC015 with 370 plants, and BTC019 with 275 plants. Often the plants were less than 5 cm tall with 1-15 capsules, and were brown and dry. The plants generally occurred along animal trails, at the edges of burrows, or in eroded places between grass tussocks. Few tiny cryptanthus plants were found in areas with a high cover of little club moss (*Selaginella densa*) or where the grass cover was tall and thick.

Grassy Lake (EO 14891) – The Grassy Lake site was a disturbed area along the south side of a graded township road. More than 500 plants were counted in 2004; however, none were found in 2007, despite surveying two transects on both sides of the road for 350 m. The habitat looks suitable with 40 percent bare ground and wind blown dirt. There are a wide variety of forbs, so herbicide use is likely not a factor.

McNeill (EO 14895) - The McNeill site was on the west side of the South Saskatchewan River approximately 10 km east of McNeill. This site was an east facing gentle midslope position with patches of bare ground. 20 plants were found in 2004. We surveyed approximately 480 m² on the north side of the existing pipeline ROW but found no tiny cryptanthus.

North of Medicine Hat (EO 14889) – This population is east of Box Spring Road on the west side of the South Saskatchewan River. The area is open sandy rangeland with east, south and west aspects and variable slopes. In 2004, over 6600 plants were found in 10 sub-populations. In 2007, most of the plants at this site were very small, dry and brown, making them difficult to find in the grassy slopes. We spent approximately 11.5 hours here, surveyed seven documented sites and found 49 plants in two sub-populations (BTC031 and BTC032). There is a large population of leafy spurge (*Euphorbia esula*) around site BTC035, although it occurs on lower slope and somewhat moister conditions than tiny cryptanthus, so it may not be a direct threat. A large population of tiny cryptanthus (greater than 1000 plants) was documented along a graded township road at BTC033N in 2004; however, we did not find any plants on either side of the road. In 2007 there was a wide variety of forbs, so herbicide use is likely not a factor. There was 40 percent bare ground, and it had been mowed.

DISCUSSION

In one of the four general locations, there appears to be a relatively good correlation between previously documented sites and current sites. In Hays Southeast two thirds of the documented sites still contained tiny cryptanthus, and there were large areas between sites that did not contain tiny cryptanthus. The Hays Southeast population count increased from 576 to 3345 plants between 2004 and 2007; however, not all 2004 sub-populations were visited, and several new locations were documented. The Medicine Hat population declined from 6600 to 46 plants, however not all sites were surveyed. Only two out of nine sites north of Medicine Hat had tiny cryptanthus, all of which were small and senescent, possibly a result of drier conditions. The average spring soil moisture levels from 1988 to 2002 (Alberta Agriculture and Food 2007) indicate that the Hays, Purple Springs, and Grassy Lake sites generally have higher soil moisture than the Medicine Hat or McNeill sites. The Grassy Lake and McNeill populations could not be found.

The sites in Hays Southeast where no tiny cryptanthe plants were found generally had dense cover of little club moss and grass, and less than 5 percent bare ground. There could be a negative correlation with little club moss that may provide some insights into the habitat requirements of tiny cryptanthe. Tiny cryptanthe was not generally found growing in crested wheatgrass patches, however in some cases where adjacent populations in native pasture were robust, there were some small plants within the crested wheatgrass areas. The largest and most robust population of tiny cryptanthe grew with many large robust Russian thistle plants, which did not appear to compete for resources. Some of the largest populations and largest plants occurred on the edges of lightly used truck trails where wind blown soil had been deposited. Tiny cryptanthe was not found in the tracks where the soil was compressed, nor on roads that had been gravelled. Occasional vehicle use and wind action appears to promote the loose bare soil that is optimal for tiny cryptanthe, while heavy vehicle use or road maintenance compacts the soil.

Further surveys should be done with permanently marked quadrats in a variety of locations and years to determine trends and variability.

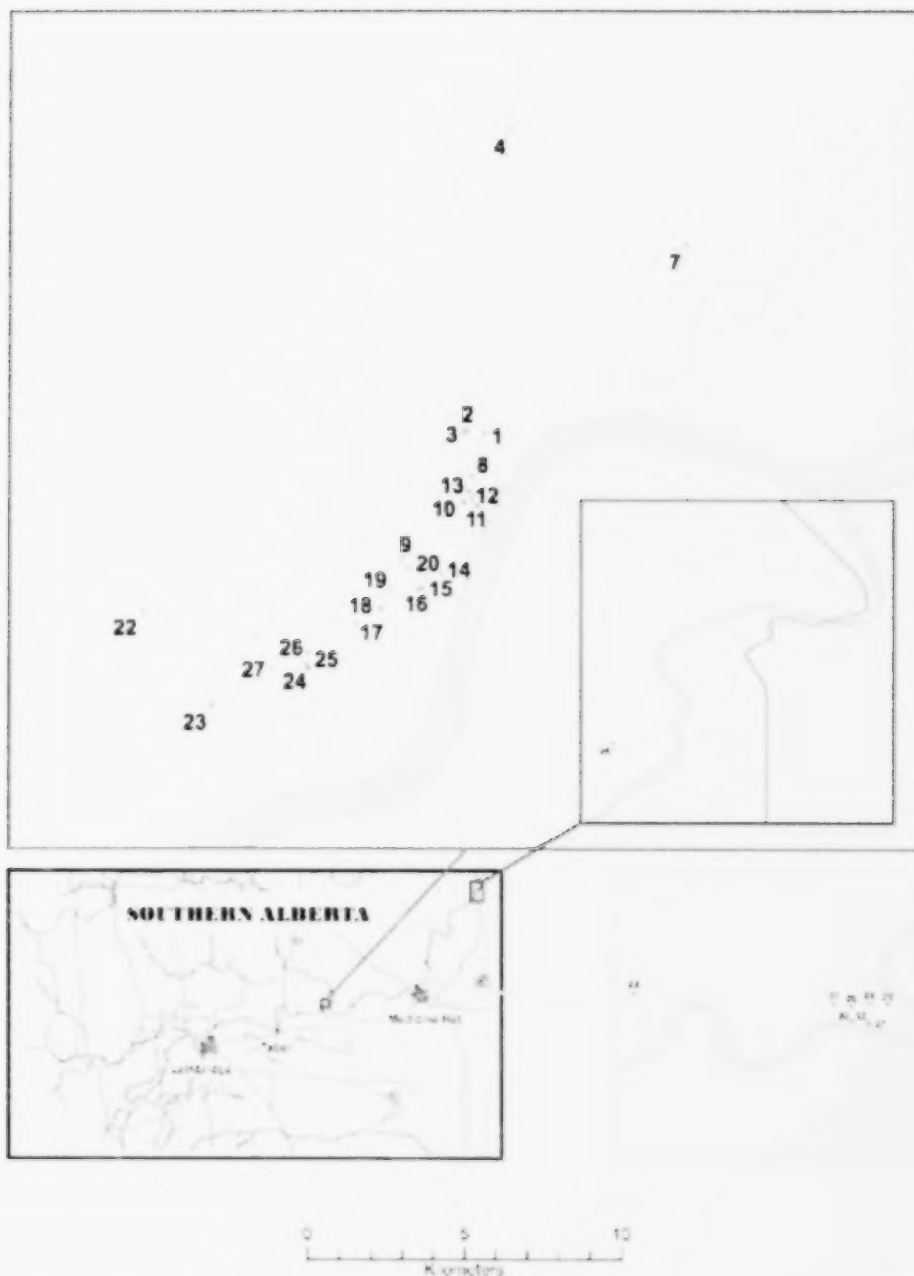


Figure 2: Survey Locations for Tiny Cryptanthus
 Numbers correspond to Site Numbers in Table 4

Table 4: Survey Locations, Effort, and Populations of Tiny Cryptanthus, 2007

General Location	EO id ¹	Site Number	Numbers of Plants ²	Sub-population Area (m ²)	Search Effort (person hours)	Search Area (m ²)	Past Populations [year (number)] and Comments ⁵
Hays Southeast (Lower Bow River)	7662	BTC001	5	0.1	3	560	2004 (400) - 86m away
		BTC002	12	26	2	642	2004 - not surveyed
		BTC003	8	*	5	*	2004 - not surveyed
		BTC004N	0	n/a	3	*	2002 (62)
		BTC005N	0	n/a	2	400	2004 - not surveyed.
		BTC006	48	10	1	500	2007- checked on the way to another site 2004 (3)
		BTC007N	0	n/a	0.5	*	2004 (5)
		BTC008	1700	240	3	5411	2004 (>50)
Hays Southeast (Lower Bow River)	7662	BTC009	52	106	1	410	2004 - not surveyed
		BTC010	115	88	1	279	2004 - not surveyed.
		BTC011N	0	n/a	1	625	2007 - BTC010, 011 012, 013 are within 100m.
							2004 element centroid 2007 (0)

General Location	EO id ¹	Site Number	Numbers of Plants ²	Sub-population Area (m ²)	Search Effort (person hours)	Search Area (m ²)	Past Populations [year (number)] and Comments ⁵
		BTC012	28	33	1	134	2004 – not surveyed
		BTC013	2	0.1	0.5	4	2004 – not surveyed
		BTC014	95	*	1	44	2004 (5)
		BTC015	370	282	2	453	2004 – not surveyed
		BTC016	50	*	1	720	2004 – not surveyed. Within 100m of BTC015
		BTC017	1	0.1	0.5	487	2004 (35)
Hays Southeast (Lower Bow River)	7662	BTC018	6	*	0.5	*	2004 – not surveyed
		BTC019	275	211	2	378	2004 (25)
		BTC020	2	4	0.5		2004 – not surveyed
		BTC021	300	480	1	*	2004 – not surveyed
		BTC022N	0	n/a	0.5	*	2004 – not surveyed.
		BTC023	200	103	2	327	2007- Checked a likely spot 2004 (20)

General Location	EO id ¹	Site Number	Numbers of Plants ²	Sub-population Area (m ²)	Search Effort (person hours)	Search Area (m ²)	Past Populations [year (number)] and Comments ⁵
		BTC024N	0	n/a	1	513	2004 (1)
							2007- Less than 100m to BTC025 & 26
		BTC025	75	22	1.5	108	2004 - not surveyed
		BTC026N	0	n/a	1.5	560	2004 (30)
Hays Southeast (Lower Bow River)	7662	BTC027	1	0	0.25	10	2004 – not surveyed
		Not surveyed		n/a	n/a	n/a	2004 (2)
		SubTotal	3345	Unknown	Unknown	Unknown	2002 (62)
				Unknown	Unknown	Unknown	2004 (>575)
Grassy Lake	14891	BTC028N	0	n/a	1	5354	2004 (> 500)
South Saskatchewan River Valley, west of McNeill	14895	BTC034N	0	n/a	1	478	2004 (20)
North of Medicine Hat, South Saskatchewan Rive	14889	BTC029N	0	n/a	2	3752	2004 (>1000)
		BTC030N	0	n/a	1	1130	2004 (20)

General Location	EO id ¹	Site Number	Numbers of Plants ²	Sub-population Area (m ²)	Search Effort (person hours)	Search Area (m ²)	Past Populations [year (number)] and Comments ⁵
		BTC031	36	28	2	282	2004 – not surveyed
North of Medicine Hat, South Saskatchewan Rive	14889	BTC032	10	21	2	344	2004 (15)
		BTC035N	0	n/a	1	989	2004 (20)
		BTC036N	0	n/a	1	604	2004 (>1000)
		BTC037N	0	n/a	1.5	746	2004 (10)
		BTC033N	0	n/a	1	784	2004 (> 1000)
		Not surveyed	n/a	n/a	n/a	n/a	2004 (300-500)
		Not surveyed	n/a	n/a	n/a	n/a	2004 (50)
		Not surveyed	n/a	n/a	n/a	n/a	2004 (>3000)
		Subtotal	46	unknown	unknown	unknown	2004 (>6600)*
Total			3391	> 1,655 m²	> 53 hours	> 27,028 m²	2002 (62) 2004 (>7695)

1. EO id: The Element Occurrence reference number assigned by the Alberta Natural Heritage Information Centre (ANHIC). EO numbers are provided here to assist in cross-referencing information in this report with information in ANHIC's database.

2. Numbers of plants counted or estimated. Numbers ending in 0's have been estimated.

3. Surveys in 2003 did not detect any tiny cryptanthus at EO id 7662.

4. Sub-populations on private land were not surveyed.

5. Totals are those recorded on ANHIC sheets

* In some cases the search area or sub-population was not recorded.

SMALL-FLOWERED SAND VERBENA

BACKGROUND

Description: Small-flowered sand verbena (*Tripterocalyx micranthus* (Torr.) Hook.) is an annual species in the four-o'clock family (Nyctaginaceae). It is a succulent, trailing plant with opposite leaves and a branching habit, and sticky stems. It has clusters of five small greenish-white tubular flowers in umbels (all branches arise from the same level). The dry seed-like fruits are encased in two or three papery translucent wings (Alberta Sustainable Resource Development 2003; Moss 1983; Kershaw et al 2001). More detailed descriptions may be found in the Alberta status report (Alberta Sustainable Resource Development 2003).

Small-flowered sand verbena is superficially similar to wild begonia, (*Rumex venosus*), which also has fruits with papery bracts and grows in similar habitats. Wild begonia, however, is a perennial plant with alternate leaves on stout erect stems, small greenish or red-tinged flowers in a dense panicle (a flower cluster where the lower branches are longest and flowering first), and larger more opaque bracts (Moss 1983).

Habitat: Small-flowered sand verbena grows in dry sandy soils, particularly in active sand on dunes and sandhills. It is found in the Dry Mixedgrass Subregion of the Grassland Natural Region in Alberta (Natural Region Committee 2006).

Reproduction – Small-flowered sand verbena is an annual plant that reproduces by seed. There may be both flowering plants and some with seeds by mid summer, and plants with mature fruits begin senescing by mid July. The seeds fall close to the plant and are then dispersed by wind, water or gravity, rolling over the sand or floating. The entire dune may be considered a seed bank; however, there is no information on the longevity of the seeds so it is not clear if stabilized dunes may also be seed banks. Further information is available in the Alberta status report (Alberta Sustainable Resource Development 2003).

Location – In Alberta, small-flowered sand verbena is associated with active sand dunes in the Lost River, Purple Springs, Grassy Lake, Wolf Island, Lower Bow, North of Medicine Hat, and in the Suffield National Wildlife Area. One population was documented along the South Saskatchewan River in Saskatchewan in 1981, but no plants were found in 2002 at this site (Alberta Sustainable Resource Development 2003).

Status – Small-flowered sand verbena is listed as a threatened species under Alberta's *Wildlife Act*, is ranked endangered in Saskatchewan (Saskatchewan Environment website 2007), and is listed as endangered on Schedule 1 of the federal *Species at Risk Act* (Government of Canada website 2008). Globally, small-flowered sand verbena is ranked as demonstrably secure under present conditions (G5) (NatureServe website 2007).

Threats – The main threats to small-flowered sand verbena are habitat losses resulting from cultivation, oil and gas development, invasion of non-native species, dune stabilization, all terrain vehicle (ATV) use, road construction, and sand extraction.

Recovery Plan – The federal national recovery strategy for small-flowered sand verbena is in the final stages of preparation (Government of Canada 2008), and a provincial recovery team is being established (Joel Nicholson pers. comm. 2007).

RESULTS

Location - Known locations (Joel Nicholson pers. comm. 2007 and Alberta Natural Heritage Information Centre 2007) in Purple Springs, Grassy Lake, and Hays Southeast were surveyed in July 2007. A total of 863 plants were found in 6 element occurrence locations (8 sub-populations) including one new site (# 16 – BSV002) in Hays Southeast. Sand verbena was not found at site #10 (BSV005N and 06N), and two additional sand hills were examined but no sand verbena was found (BSV015N and 016N (Figure 3, Table 5).

Population – A total of 1400 plants was counted during 2007, substantially fewer than in 2002. The largest numbers were in the two most disturbed sub-populations: Site #5 C (EO #15232), which is a large dune at Purple Springs that is used by ATVs, and Site #6 (EO #9331) which is the sand extraction pit at Grassy Lake. The numbers appear to fluctuate from year to year in each element occurrence, but the total population is not comparable from year to year because the survey effort varies. It appears that the population numbers were highest in 2002 even though only three EOs were surveyed. Numbers in 2007 were higher than 2004 in four out of seven EOs. The largest decline was in the Grassy Lake site where a sand pit has removed most of the habitat

Purple Springs (EO 9325)

A small population (five plants) of small-flowered sand verbena was found on the northeast portion of the dune complex on a south facing slope. Previous surveys documented 30 plants in 1987 and 20 plants in 2004. The entire dune was surveyed, as well as a low well-vegetated dune to the east, which did not have suitable habitat. The sand verbena occurred in 90 percent bare ground, with silver sagebrush, Indian rice grass, scurf pea, skeleton weed (*Lygodesmia juncea*) and wheatgrass (*Agropyron* sp.). Non-native species such as crested wheatgrass, downy brome, and Russian thistle were present in the area, and a large population of leafy spurge was found at the base of the dune complex to the west.

Purple Springs – Site 5

The following three dune complexes are included in Site 5 (Alberta Sustainable Resource Development 2003) and are within 1 km of each other.

Purple Springs – 5A (EO 9332) is a dune closest to the road, and is 6942 m². Ten plants were found on the north and south slopes of the dune bowl, although this may be an underestimate as the plants were senescent by July 23. On July 13 2002, 269 plants were observed at this site, and on July 15, 2004, 101 plants were observed.

A small population of the provincially rare common dodder (*Cuscuta gronovii*) was also found on a trail exiting the pit on the west side (see Section 6 for more details).

Hays Southeast (Lower Bow) (EO 9337)

This site was a large oval dune (8219 m²) with a moist bottom, approximately 2.3 km north of the Bow River. The dune can be clearly seen on the air photos supplied by ASRD (Joel Nicholson pers. comm. 2007). 179 sand verbena plants were found on the inside of the dune on open eroding slopes (12 to 20 degrees) facing southeast, south and west. Past surveys documented 12 plants in 1987 and 209 in 2004. The local habitat was 80 percent bare ground, with Indian rice grass, sand grass, and scurf pea. Russian

thistle was also present. Prickly milkvetch (*Astragalus kentrophyta*), a provincially rare species, grew in the basin (see Section 6 for more details).

Hays Southeast (Lower Bow) (EO 9323)

Two sites, approximately 10 m apart, were surveyed in an effort to locate this population. The first site, which matches the coordinates of the element occurrence, was level ground with no dunes or exposed sand. The second site was a low, well-vegetated dune complex. The few slopes with open sand had firm surfaces and were not slumping. No sand verbena plants were found in 2007. In 1987, 3 plants were found, but later surveys (1992 and 2004) indicate that no plants were found at either site, and the surveyors concluded that the UTM coordinates from the first survey date were incorrect, and that the small dune at the second site may have had suitable habitat at one time, but no longer (Alberta Natural Heritage Information Centre 2007). Seed may still be present in the dune, therefore it should be considered a dormant population.

Hays Southeast (Lower Bow) (EO 9339)

This site is a dune bisected by a north/south fence and a truck trail. The dune, the road and the dune west of the fence were surveyed. 172 plants were found primarily along the truck trail, with 11 plants on the southwest slope of the eroded dune wall. The dune west of the fence was completely vegetated, with no sand verbena present. Three surveys have been done here, recording populations ranging from 2 (2003) to 789 (2002).

Hays Southeast (Lower Bow) (EO7662)

This was a new site found while looking for tiny cryptanthus. The dune (7531 m²) has a single depression, and is west of a dug-out. The dune can be seen on the air photos provided by ASRD (Joel Nicholson pers. comm. 2007). 16 sand verbena plants were located on the north side of the depression, facing south.

BSV0015N and BSV0016N

This site was recorded on the ASRD air photos (Joel Nicholson pers. comm. 2007) as a potential site, but was not included in the ANHIC data (Alberta Natural Heritage Information Centre 2007). BSV016 was a low dune (1.5 m high) west of the dirt road and north of a pipeline seeded to crested wheatgrass. It was completely vegetated and had no bare ground. BSV015 was a larger dune complex on the west side of the road and fenceline. It was approximately 2 m high, with open sand by the fenceline; the rest of the dune was well vegetated. Sand verbena was not present on either dune.

DISCUSSION

Sand verbena does not grow on actively slumping sand slopes, nor where silver sagebrush or sand grass has stabilized the dune. It's found on the edges of active dunes where there is greater than 70 percent bare ground and some shifting sand (with scurf pea and Indian rice grass). Large populations may extend down into the flats and grow with wild begonia.

Dune stabilization and sand extraction appear to be the largest threats to small-flowered sand verbena populations, as well as grazing (or lack of), ATV and truck traffic, and competition from non-native species. Small-flowered sand verbena may be adapted to periodic disturbance and revegetation cycles by producing long-lived seeds that persist when buried in the sand, but do not germinate until they are exposed to appropriate light and moisture conditions. Sand dunes that historically supported sand verbena populations may contain seeds that could germinate during another disturbance cycle.

Wallis and Wershler (1988) estimated that there had been a 25 to 40 percent reduction in the active sand dune area in Purple Springs from 1951 to 1987, and the ANHIC rare plant records show several dunes have become vegetated and no longer support small-flowered sand verbena populations (Alberta Natural Heritage Information Centre 2007). Several populations of sand verbena documented in the past were on currently stabilized dunes which no longer supported live populations

Sand extraction has removed substantial portion of the habitat at Grassy Lake and has resulted in a precipitous decline in the number of plants. Sand verbena persists on the loose sand along the sides of the pit and in the flats above. According to the manager of the gas battery, the sand pit is now too close to the sour gas pipeline on the north side and he has told the operators that they can no longer use the access road. Sand extraction may have stopped unless / until they establish an alternative route.

Grazing appears to be a suitable land use, as the hoof action of cows and horses can maintain open sand. Heavy grazing during the spring and early summer, however, may result in a loss of plants as cattle will eat sand verbena (Alberta Natural Heritage Information Centre 2007). ATV and truck use during the fall may keep the dunes open and benefit sand verbena; however, ATV use (quads and motorbikes) was noted to have killed several plants on the dune slopes at the Purple Springs location (Alberta Sustainable Resource Development 2003). Upgraded roads stabilize the soil, eliminating sand verbena habitat.

Non-native species such as Russian thistle, downy brome, flixweed (*Descurainia sophia*), sand rocket (*Diploaxis muralis*), red-root pigweed (*Amaranthus retroflexus*), and lamb's quarters (*Chenopodium album*) are abundant (Alberta Sustainable Resource Development 2003), and numerous wellpads in the Lower Bow site have been seeded with crested wheatgrass. Non-native invasive species may stabilize dune habitats and out compete small-flowered sand verbena.

Future Surveys – It appears, from air photos, that there are sand dunes within Hays Southeast and Purple Springs that have not been surveyed for small-flowered sand verbena, and known sites at Hays Southwest (Wolf Island) were not surveyed in 2007. In order to estimate the current population, these sites should be surveyed. Research into seed bank longevity in historical sites on dunes that are currently stable and not supporting small-flowered sand verbena would provide important information on population viability.



Figure 3: Survey Locations for Small-flowered Sand Verbena
Numbers correspond with Site Numbers on Table 5.

Table 5: Survey Locations, Effort, and Populations of Small-flowered Sand Verbena, 2007

General Location	EO id ¹	Site Number	Number of Plants	Population Area (m ²)	Search Effort (person hours)	Search Area (m ²)	Site # from Status Assessment ²	Past Populations [year (number)] and Comments ⁴
Purple Springs	9325	BSV001	5	5	6	9495	4	1987 (30)
	9332	BSV008	10	-	2.5	6942	5, subsite A	2004 (20)
	15231	BSV009	54	520	3	2611	5, subsite B	2002 (269)
		BSV010	1	0.25	1	521		2004 (101)
	15232	BSV013N	0	0	0.25	-	5, subsite C	2004 (20)
		BSV011	253	1702	4	3585		2004 (167)
		BSV012	234	195	2	4237		
Grassy Lake	9331	BSV014	462	6263	5	8862	6	2002 (3024)
Hays Southwest (Wolf Island)	9330	Leasee's not available	-	-	-	-	7, subsite A	2004 (100)
	9324	Leasee's not available	-	-	-	-	7, subsite B	1987 (100)
Hays Southeast (Lower Bow)	9337	BSV003	179	2318	5	8219	8	2004 (20)
								1987 (12)
	9329	not surveyed	-	-	-	-	9	2004 (209)
								1987 (250)
	9323	BSV005N,	0	0	1	-	10	2004 (0)
								1987 (3)
								1992 (0)
	9339	BSV004	183	165	1	-	11	2004 (0)
								2002 (789)
								2003 (2)
								2004 (97)

Table 5: (continued)

General Location	EO id ¹	Site Number	Number of Plants	Population Area (m ²)	Search Effort (person hours)	Search Area (m ²)	Site # from Assessment ²	Status	Past Populations (number)] Comments ⁴	year and
Hays Southeast (Lower Bow)	n/a	BSV015N	0	0	0.5	-	null		New site (null)	
	n/a	BSV016N	0	0	0.5	-	null		New site (null)	
	7662 ³	BSV002	16	235	2	7531	16		New site	
Total			1400	11403 m2	34.25 hours	52,003 m2			1987 (405) 2002 (4082) 2003 (2) 2004 (743)	

Source: Alberta Natural Heritage Information Centre July 2007; Alberta Sustainable Resource Development 2003.

1. EO id: The Element Occurrence reference number assigned by the Alberta Natural Heritage Information Centre (ANHIC). EO numbers are provided here to assist in cross-referencing information in this report with information in ANHIC's database.

2. Location names and site #'s are from ASRD (2003).

3. EO id is for a tiny cryptanthus location

4. Totals are those recorded on ANHIC sheets

* In some cases the search area or sub-population was not recorded.

OTHER RARE SPECIES

Prickly Milkvetch **(*Astragalus kentrophyta*)**

Prickly milkvetch is a low growing legume with spine- tipped leaves and small cream- coloured flowers. It grows in dry prairies, in hard-packed or gravely sand in blowout areas, or on exposed eroding soils such as along trails (Kershaw et al 2001). It is listed S1 in Alberta (Gould 2006). May be at Risk (Alberta Sustainable Resource Development 2005) and is globally secure (NatureServe website 2007). Two locations were found in Hays Southeast.

BAK001 – Approximately 800 prickly milkvetch plants were found in a hard flat area in low vegetated sand dunes. There was 60 percent bare ground, with sand grass, scurf pea, annual lupine (*Lupinus pusillus*), western wheatgrass, and white sweet-clover (*Melilotus alba*). A truck track is adjacent, and this spot is used for occasional parking.

BAK002 – Approximately 1800 prickly milkvetch plants were found on the hard floor of a dune depression with small-flowered sand verbena growing on the sides of the dune (BSV003). There was 80 percent bare ground with sand grass, sweet clover, annual lupine, Missouri goldenrod (*Solidago missouriensis*), scurf pea, needle-and-thread grass, plain reed grass (*Calamagrostis montanensis*), pussy-toes (*Antennaria* sp.), bluegrass (*Poa* sp.), and lotus (*Lotus corniculatus*).

Common Dodder **(*Cuscuta gronovii*)**

Common dodder is an annual, parasitic plant in the morning-glory family. It has orange or yellow stems that twine and climb on other plants (looking rather like cooked spaghetti dropped in the garden). Although the seeds germinate in the soil, once it begins climbing the roots atrophy and aerial roots attach to the host plant to draw out nutrients (Kershaw et al 2001). Common dodder is listed as an S1 species in Alberta (Gould 2006), and May be at Risk (Alberta Sustainable Resource Development 2005), but it is also listed on the Provincial Weed Act as a restricted weed (Alberta Agriculture and Food website, 2008).

BCG001 / BSV014 - Common dodder was found at the sand extraction pit in Grassy Lake on a small 3 m wide trail exiting the pit. Common dodder was growing on sand begonia, which appeared unaffected, and on unidentified goosefoot plants (*Chenopodium* sp.), which were wilted and dry. We counted 13 plants with dodder, but could not identify the actual number of dodder plants. The surrounding area was 90 percent bare ground.

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